

Radically Contested Assertions in Ecosystem Management

Robert T. Lackey

National Health and Environmental Effects Research Laboratory
U.S. Environmental Protection Agency
200 SW 35th Street
Corvallis, Oregon 97333

Robert.Lackey@oregonstate.edu
(541) 737-0569

Citation: Lackey, Robert T. 1999. Radically contested assertions in ecosystem management. *Journal of Sustainable Forestry*. 9(1-2): 21-34.

Available on the web:

<http://oregonstate.edu/dept/fw/lackey/RecentPublications.html>

Radically Contested Assertions in Ecosystem Management¹

Robert T. Lackey

ABSTRACT

As an approach to attain ecological policy objectives, ecosystem management is a magnet for controversy, in part because some of its formulations rest on questionable assertions that may be termed radically contested. These assertions are important to understanding much of the conflict surrounding ecosystem management and, therefore, deserve thoughtful discussion and vigorous debate. Unfortunately, the assertions usually receive little scrutiny because critics, supporters, and the public are, understandably, absorbed in the personal and societal consequences of implementing controversial public policy choices under the rubric of ecosystem management. Professional natural resource managers, typically operating from within government bureaucracies and professional organizations, tend to blunt debate over the critical assertions. Deliberately or not, they steer the practical meaning of ecosystem management toward the prosaic designation of an evolutionary stage within the well-established natural resource management paradigm. In such a bureaucratic reformulation and redefinition by experts, ecosystem management becomes simply a fashionable description of the time-honored natural resource management paradigm in which society's values and preferences change (as professional natural resource managers presume) and the process of natural resource management (ecosystem management) incorporates the change. There is nothing deceitful or diabolic with such efforts to depict ecosystem management in terms of a classically technocratic approach to implementing ecological policy, but it does blunt much of the moral and political passion underlying many formulations of ecosystem management. Other proponents, usually from outside the traditional natural resource management professions, contend that ecosystem management is revolutionary, not evolutionary. In this more radical view, ecosystem management is much more than a mere reformulation of classic natural resource management. To accept such a radical view of ecosystem management, I propose that there are four necessary, but implicit assertions. Each of the assertions leads directly to a policy corollary that, if accepted, would have major ramifications for public policy. None of the assertions is accepted without challenge: each has articulate supporters and detractors. My conclusion from evaluating the radically contested assertions and policy corollaries is that much, but not all, of what is alleged as a scientific basis for ecosystem management is an assertion of fundamental values or, at the very least, an expression of personal policy preferences. It is incorrect to say that ecosystem management should be science-driven; rather, ecosystem management is dependent on, but constrained by, science and scientific information.

¹ The views and opinions expressed do not necessarily represent those of any organization.

INTRODUCTION

Ecosystem management has become a magnet for controversy (Fitzsimmons, 1996; Haeuber, 1996; Gilmore, 1997). On one side of the multi-sided debate, and reflecting a common view held by professional natural resource managers, is a business-as-usual philosophy:

"I promise you that I can justify anything you want to do by saying it is ecosystem management. Not that I don't think it is a good idea. I applaud it. But right now it's incredibly nebulous." [Jack Ward Thomas, Chief of the U.S. Forest Service, speech to Forest Service public affairs personnel, April 11, 1993, as quoted in Fitzsimmons (1996)]

"The move to ecosystem management concepts is an evolutionary process that has been underway for decades and is becoming more and more feasible with developments in science, technology, and philosophy. The fuller embrace of the concept of ecosystem management is correctly identified as evolutionary as opposed to revolutionary." (Thomas, 1996)

In marked contrast, ecosystem management represents to others nothing less than a fundamental change in social policy:

"The philosophy of ecosystem management requires asking ourselves what kind of a society, and correspondingly, what kind of relationship with nature we want. Patterns of politics suggested by ecosystem management include public deliberation of values toward the environment, cooperative solutions, and dispersion of power and authority. These are all avenues to lessen social hierarchy and domination. Through opening the value debate, fostering a sense of interdependence among humans, and renewing a sense of reason, the chains of social domination may be lessened." (Wallace et al., 1996)

Another set of proponents view society's adoption of ecosystem management as a fundamental shift in values, ethics, and morals:

"A human community in a sustainable relationship with a nonhuman community is based on the following precepts: first, equity between the human and nonhuman communities; second, moral consideration for both humans and other species; third, respect for both cultural diversity and biodiversity; fourth, inclusion of women, minorities, and nonhuman nature in the code of ethical accountability; and fifth, that ecologically sound management is consistent with the continued health of both the human and the nonhuman communities." (Merchant, 1997)

Still others pattern their vision of ecosystem management as reaching a higher stage of human consciousness:

“Ecosystem management defines a paradigm that weaves biophysical and social threads into a tapestry of beauty, health, and sustainability. It embraces both social and ecological dynamics in a flexible and adaptive process. Ecosystem management celebrates the wisdom of both our minds and hearts, and lights our path to the future.” (Cornett, 1994)

Formulations of ecosystem management that purport to “lessen social hierarchy and domination” or call for “moral consideration for both humans and other species” or celebrate “the wisdom of both our minds and hearts, and lights our path to the future” do not sound like business-as-usual. Admitting that a natural resource manager “can justify anything you want to do by saying it is ecosystem management” would, however, support the precept that ecosystem management is so vague a concept as to be operationally meaningless.

ASSERTIONS

The more revolutionary formulations of ecosystem management that purport to be a radical shift in public policy rest on several fundamental postulates — what may be termed radically contested, or highly questionable, assertions. How these assertions are adjudicated will determine whether the label “ecosystem management” connotes business-as-usual or a fundamental shift in ecological policy. It is the assertions that are important in interpreting most of the conflict swirling around ecosystem management.

Unfortunately, the assertions usually receive little formal or coherent scrutiny — mainly because critics, supporters, and the public are, understandably, absorbed in the personal and societal consequences of implementing controversial public policy choices under the rubric of ecosystem management. The assertions are rarely articulated and debates often center around elements of scientific understanding.

Further inhibiting debate over the critical assertions is the tendency by professional natural resource managers and scientists (especially in the fisheries, forestry, and wildlife disciplines), operating from within government bureaucracies and professional organizations, to steer ecosystem management toward being simply an evolutionary stage of the well-established natural resource management paradigm:

“Ecosystem management is not a rejection of the anthropocentric for a totally biocentric world view. Rather, it is management that acknowledges the importance of human needs while at the same time confronting the reality that the capacity of our world to meet those needs in perpetuity has limits and

depends on the function of ecosystems.” (Christensen, et al., 1995)

“ . . . there is no a priori imperative to include management for biodiversity, ecosystem health and integrity, and commodity production in every ecosystem-management effort, and therefore to specify them in a general definition.” (Wagner, 1995)

In such a bureaucratic reformulation and redefinition by experts, ecosystem management becomes merely a contemporary description of the time-honored natural resource management paradigm where society's values and preferences change (as professional natural resource managers presume) and the *process* of natural resource management (ecosystem management) incorporates such changes (Lackey, 1998). There is nothing deceitful or diabolic with such efforts to depict ecosystem management in terms of a classically technocratic approach to implementing ecological policy, but it does blunt much of the moral and political passion underlying many formulations of ecosystem management.

In spite of pervasive efforts by government bureaucracies and natural resource professionals to appropriate the jargon of ecosystem management as an evolution of the traditional natural resources management paradigm (Fitzsimmons, 1996, 1998; Thomas, 1996), some proponents (Merchant, 1997; Wallace, et al., 1996) claim, usually outside the professional venues of natural resource managers and scientists, that ecosystem management is revolutionary, not evolutionary, and it is much more than a mere reformulation of the classic natural resource management paradigm. But the revolution/evolution split is not articulated because it is usually uncertain whether the participants are arguing over technical or administrative implementation, or are debating a fundamentally different set of premises. Also masking the fundamental issues is that the same words often are used with very different meanings.

My purpose is to identify the fundamental premises upon which the revolutionary view of ecosystem management is based. After reviewing the recent literature (both formally published and the many dialogs and debates held on computer list servers), I propose that there are four implicit assertions that constitute the underpinning of the revolutionary view of ecosystem management. Each of the assertions leads directly to an ecological policy corollary that, if accepted, would have major ramifications on public policy and natural resources management. None of the assertions is accepted unchallenged; each has eloquent supporters and detractors, but all continue to be radically contested.

Assertion #1 — *Ecosystems are real.*

Policy Corollary — *Ecosystems can and should be managed.*

What is an ecosystem? The easy answer is a generic text definition, but these definitions are so general as to be of limited use in management (Fitzsimmons, 1998). In practice, however, ecosystems are defined at scales from a drop of morning dew to an ocean, from a mountain meadow to a continent, or from a pebble to a planet. Thus, there are things that we commonly call ecosystems, but their scale is determined by the management problem at hand. Must we be constrained to deal in specifics when defining and bounding ecosystems? If dew drops and continents legitimately may be defined as ecosystems, then what practical value is added by using the ecosystem concept in decision making?

Perhaps there are other “ecosystem” concepts that might delimit boundaries and thus be useful in management or policy analysis? One possibility is the “watershed.” Watersheds have fairly discrete boundaries but a scale must first be defined. As with ecosystems, scale may range from a few meters to millions of kilometers. Another possibility is use of the term “ecoregion.” Ecoregions, however, are only tolerably discrete once the attributes of an ecoregion are codified. As with ecosystems and watersheds, the attributes of ecoregions are context (problem) specific.

Thus, the boundaries or definition of ecosystems in ecosystem management (and watersheds or ecoregions) are entirely derived from the specific management or policy question being addressed. There are no general characteristics of ecosystems that are useful in setting specific boundaries *a priori*. In short, ecosystems are, and will always be, entirely context specific.

Because there are no *a priori* boundaries for ecosystems in the absence of a particular policy or management question, the central issues become: (1) what is the policy or management problem at hand? and (2) who has a mandate to adjudicate among competing visions of the policy or management question? For example, is ecosystem management limited to managing public forest lands? Such a rigorously constrained definition of the management focus (public forest lands) simplifies policy and ecological analysis, but who decides that such a narrow focus is appropriate? Or should ecosystem management focus on ecosystem boundaries independent of ownership? Why the apparent focus on publicly owned forest lands? Are not urbanized areas equally relevant and appropriately included within the boundaries of ecosystems?

The assertion that ecosystems are real must be accompanied by the caveat that ecosystems are real only in the sense that a specific management, policy, or scientific problem has been articulated, thus permitting the ecological boundaries (the ecosystem) of concern to be delimited. Accepting the assertion that ecosystems are real means that someone has defined the management, policy, or scientific problem — that is, set the relative values and preferences of concern.

If the assertion that ecosystems are real (in a policy or management sense) is accepted, then the policy corollary (*“ecosystems can and should be managed”*) is a logical adjunct. Because ecosystems are defined in a policy or management context, the significant public debate should be over delineation of the policy problem to be solved. Once the policy problem (or societal goal) is defined, the ecosystem boundaries will probably be deduced with relative ease because it is largely a scientific exercise.

Thus, the assertion that *“ecosystems are real”* is tenuous. The corollary *“ecosystems can and should be managed”* is only true once the policy or management goal is defined and accepted. Having articulated the policy or management goal, the ecosystem includes all the ecological components necessary to meet the goal.

Assertion #2 — *Natural and undisturbed is inherently preferable to altered and disturbed.*

Policy Corollary — *Native species are inherently more important than exotic species and, therefore, biological diversity should not be reduced.*

Though not clearly stated, in many formulations of ecosystem management there is a tacit assertion that natural ecosystems are inherently preferable to unnatural (or human altered) ecosystems. Some are more direct, bluntly stating that “Ecosystem management is a response to today’s deepening biodiversity crisis” or declaring that ecosystem management has “. . . the general goal of protecting native ecosystem integrity over the long term” (Grumbine, 1994). “Integrity” is, by definition, based on native species and native ecosystems. By implication, man’s activities are inherently bad or adverse. Perhaps there is an admission that humans need the products and services of ecosystems to survive, much less prosper, but it is almost as if this need was an unfortunate but unavoidable reality. Even in bureaucratic formulations of ecosystem management, terms such as “degradation,” “health,” and “impoverishment” imply that the benchmark for ecosystems is no disturbance, and that human disturbance results in some degree of “degradation,” something less than optimal “health,” and a reduction in biotic “richness.”

Another area in which assertions of preferences arise is in definitions of what appear to be scientific terms. For example, what is meant by ecological integrity? A typical answer is provided by Westra (1996a): “An ecosystem can be said to possess integrity when it is wild; that is, free as much as possible today from human intervention. It is an ‘unmanaged’ ecosystem, although not necessarily a pristine one.” The word *integrity* typically connotes “goodness” or “desirability.” Therefore, human intervention must, by definition, reduce integrity.

The importance placed on the pedigree of the species present in an area also shows a common acceptance of the policy corollary that native species are more important than exotic species. Exotic species may be called “. . . the Gestapo of ecology” (Windsor, 1998), but usually their status is less obviously stated. For example, exotic species are routinely excluded in measuring biological diversity. Why are native species more important than exotic species? Further, among the exotic species, why are intentional introductions usually treated differently than unintentional introductions relative to biological diversity? Should the same ideas apply to humans? *Homo sapiens* in North America, for example, was (or is) an exotic species.

Individuals and society may value certain species more than others or it may value all species equally, but such valuations are societal preferences, not scientific judgments. In fact, concepts such as biological diversity reflect an element of societal preference and scientific understanding. However, the use of a scientific imperative to justify protecting biological diversity is an example of mythology (Ghilarov, 1996). Whether society prefers “natural and undisturbed” ecosystems to “altered and disturbed” is purely a societal judgment. There is nothing inherent in science that makes either pristine or altered ecosystems inherently preferable from a policy standpoint.

Assertion #3 — *Everything is connected to everything else.*

Policy Corollary — *Ecosystem management is best done within large geographical areas.*

There is a tantalizing appeal to the premise that everything in nature, and all of ecological policy for that matter, is related to everything else. After all, the air currents caused by a single butterfly flapping his wings once could plausibly be the stimulus for a hurricane on the other side of the earth, but no one can predict *a priori* the consequences of a butterfly flapping his wings. Scientists and analysts must simplify problems in science and policy at their peril or they cannot predict anything with confidence.

The reality in decision analysis is that some simplifications must be made or it is impossible to conduct any credible scientific or policy analysis. The question is how much simplification is warranted. For example, all decisions are constrained by boundaries, physical, biological, and social. Boundaries must be applied to decision problems (or scientific analyses) in order to make analytical work tractable. The tradeoff at the extremes is between scientific rigor (e.g., simple physical, chemical, or biological models) that has limited direct policy relevance and more complete models (e.g., computer simulations of complex systems) that are more realistic in a policy sense, but are not credible scientifically.

What about arguments for “holistic” or “bioregional” management that are advanced by some proponents of ecosystem management? Such arguments may have a superficial appeal, but the issue is where the boundaries are drawn, not whether policy problems are “holistic” or not. It may be difficult to be against holistic approaches, but where does society draw policy or scientific boundaries -- a population of deer, a local watershed, an ecoregion, a biome, a continent, the planet? In practice the boundary must be set somewhere, otherwise ecosystem management will sink into flowery rhetoric, and not be useful in solving societal problems.

Some implicitly argue that the policy corollary to “everything is related to everything else” is that boundaries ought to delimit very large areas — implicitly accepting that the policy problems of concern are best addressed over large regions. What scale? Bioregional scales are popular in much of the literature, but who defines policy questions that justify boundaries at such a geographic level? Studying ecological problems over large regions has a certain scientific rationale, but it does not follow that government “management” programs work well across large regions.

The policy and social implications of implementing ecosystem management within large geographic areas would potentially be a sea change in ecological policy. As Cortner and Moote (1994) observe:

“A paradigm shift to actual ecosystem-level management will not be possible under the existing management structure, which divides land and water along political boundaries and sections ecosystems into commodity resources.”

Political boundaries may sound innocuous to the casual reader, but Cortner and Moote go on to elaborate that professional natural resource managers must, in order to implement ecosystem management, adopt “. . . a radical revision of our own values, management practices, and institutional structures” Is such a requisite fundamental shift in thought acknowledgment that ecosystem management requires greater government over private property? The answer offered by Fitzsimmons (1998) is explicit:

“Full implementation of a policy of federal management and protection of ecosystems would extend the reach of federal regulators to all private land in the United States, increase regulatory burdens, and further restrict the economic use of public and private lands.”

Assertion #4 — *There is a moral imperative for ecosystem management.*

Policy Corollary — *The benefits and costs of decisions in ecosystem management are accruable to all ecosystem components, not solely to humans.*

No aspect of the debate over the proper interpretation of ecosystem management is more crucial than the assertion that there is a moral imperative for its implementation. For example, in discussing the philosophical and moral basis for managing natural resources, Westra (1996b) concludes with an opinion on the role of citizen choice relative to a larger philosophical and moral mandate:

“Thus, no country’s unilateral decisions, no matter how representative it might be of its citizens’ values, should be permitted to prevail, unless it does not conflict with the global requirements of the ethics of integrity, thus with true sustainability.”

Exactly what is the moral imperative to protect ecological integrity, an imperative that is often a cornerstone of ecosystem management? Who defines it? At least for the question of *who* defines integrity, there is one obvious answer offered by proponents: scientists. Being anointed with the mandate to define ecological integrity conveys an enormous influence in disputes over ecological policy. In evaluating the role of scientists within such a policy context, Sagoff (1995) observed:

“To be sure, both community and systems ecology retained faith with the central thesis of the Great Chain of Being that nature exemplifies a timeless and intelligible order rather than sheer historical contingency. By secularizing this religious intuition, however, ecosystem science replaces a priesthood of theologians with one of engineers and mathematical modelers.”

As best I can untangle it, the alleged moral imperative for ecosystem management is that humans are entrusted with protecting the world. There may be an implicit policy corollary that all species are equal and that each should be treated properly: species or individuals other than humans should be considered in ecosystem management beyond their role in achieving human benefits. The obvious competing moral imperative is that benefits from decisions in ecosystem management are accruable only to humans. It follows from this human-centered assertion that society *may* wish to safeguard natural ecosystems, sustain all species, preserve all populations, shield from harm all *individual* mammals, birds, and fish, or hold entire continents free of human habitation. But the reason that society might do these things, if the human-centered moral imperative is accepted, is because the benefits to *humans* are worth the costs.

There is, of course, nothing wrong with asserting a moral imperative for ecosystem management except that the world is made up of competing moral imperatives. Nor can ecology or any other scientific discipline help much in resolving the debates because science and scientific information deals with the “what is” questions and not the “what ought to be” questions. Consider, for example, the question of whether a wetland should be preserved? Converting a swamp to a corn field, university campus, or parking lot has ecological consequences which must be determined scientifically, but whether we *want* the wetland, soybean field, university campus, or parking lot is a societal decision.

Assertions of moral imperatives are not limited to formulations of ecosystem management. Heilig (1997), for example, concludes a critical analysis of ecological policy in general and sustainable development in particular with:

We should be aware that the sustainability concept until now has mainly been a social philosophy, packed with hidden assumptions, values, and lifestyle ideals. Popular among sustainability advocates is the Calvinistic ‘slow-down’ philosophy: we should limit our traveling, our eating of red meat; we should lower the temperature in our apartments, and use bicycles instead of cars.

The assertion that there is a moral imperative for ecosystem management (essentially that benefits and costs of decisions are accruable to all ecosystem components) is a radical concept. Scientists and scientific information are not relevant in determining the acceptability of such an assertion. A formulation based on such an assertion would be revolutionary in concept and application. [My guess is, however, that many of the proponents of such a moral imperative tacitly accept the more traditional human-centered assertion (benefits are accruable to humans), but they place much higher relative value on ecosystems, species, or individual nonhuman plants and animal survival than the average citizen.] The debate has the character of an argument over a human-centered management vs. a bioegalitarian paradigm, but the debate is really over the relative importance of alternative benefits (e.g., paper vs. spotted owls, hamburger vs. wolves, electricity vs. white water rafting, etc).

CONCLUSION

After evaluating the radically contested assertions and policy corollaries of ecosystem management, I conclude that much, but not all, of what is proclaimed as a scientific basis for ecosystem management is, at its heart, an assertion of fundamental values. At the very least, the claimed scientific basis for ecosystem management is an expression of personal policy preferences. To fairly characterize ecosystem management or to debate its appropriateness as a public policy paradigm, it is essential to clearly separate those elements of the paradigm that should be driven by science from those components that should be based on individual or societal values and preferences.

It is fallacious to say that ecosystem management, or the traditional natural resources management paradigm, should be science-driven. Rather, it is more accurate to say that ecosystem management is dependent on, but constrained by, science and scientific information. Regardless of how ecosystem management may be defined and which, if any, radically contested assertions are invoked, a key role of ecological (scientific) information is to identify the limits or constraints that bound the options to achieve various societal, or in some formulations of ecosystem management, *non*societal, benefits. Ecological information is important in implementing effective ecosystem management (or any alternative management paradigm), even though it is only one ingredient in the decision-making process that should be driven largely on public or private choices.

There appear to be two policy trajectories for resolving the operational meaning of ecosystem management. The first, and most likely to happen, is that the expression “ecosystem management” might be defined as functionally equivalent to the classic natural resource management paradigm and merely reflects another stage in evolving societal values and preferences. The other path is that “ecosystem management” will come to be the policy banner for an eco-centered world-view closely tied to concepts of species egalitarianism, bioregionalism, democratization, and possibly local empowerment.

In spite of the scientific character of much of the debate over ecosystem management, most of the divisive issues are not scientific: they are most often clashes over moral and philosophical positions or different individual preferences. In the absence of a societal consensus on the radically contested assertions I have described, it will be extremely difficult to harmonize the divisive issues in ecosystem management. Stated in a more pragmatic context, the policy debate in ecosystem management will continue to be who or what wins and who or what loses and over what period of time.

Ecosystem management remained relatively free of controversy as long as it was defined in sufficiently general terms so that nearly anyone's policy position plausibly could be accommodated. Efforts to demand precision of thought, however, have forced deep-seated moral, philosophical, and economic divisions to the surface. Rather than be judged a political platitude that offends no one, ecosystem management has become a lightning rod for controversy in public policy.

LITERATURE CITED

- Cornett, Zane J. 1994. Ecosystem management: why now? *Ecosystem Management News*, USDA Forest Service. 3(14): no page numbers.
- Cortner, Hanna J., and Margaret A. Moote. 1994. Trends and issues in land and water resources management: setting the agenda for change. *Environmental Management*. 18(2): 167-173.
- Christensen, Norman L., *et al.* 1995. The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management. *Ecological Applications*. 6(3): 665-691.
- Fitzsimmons, Allan K. 1996. Sound policy or smoke and mirrors: does ecosystem management make sense? *Water Resources Bulletin*. 32(2): 217-227.
- Fitzsimmons, Allan K. 1998. Why a policy of federal management and protection of ecosystems is a bad idea. *Landscape and Urban Planning*. 40(1/3): 195-202.
- Ghilarov, Alexej. 1996. What does 'biodiversity' mean -- scientific problem or convenient myth? *Trends in Ecology and Evolution*. 11(7): 304-306.
- Gilmore, Daniel W. 1997. Ecosystem management — a needs drive, resource-use philosophy. *The Forest Chronicle*. 73(5): 560-564.
- Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology*. 8: 27-38.
- Haeuber, Richard. 1996. The case of ecosystem management. *Natural Resources Journal*. 36: 1-28.
- Heilig, Gerhard K. 1997. Sustainable development — ten arguments against a biologicistic 'slow-down' philosophy of social and economic development. *International Journal of Sustainable Development and World Ecology*. 4: 1-16.
- Lackey, Robert T. 1998. Seven pillars of ecosystem management. *Landscape and Urban Planning*. 40(1/3): 21-30.
- Merchant, Carolyn. 1997. First first!: the changing ethics of ecosystem management. *Human Ecology Review*. 4(1): 25-30.
- Sagoff, Mark. 1995. The value of integrity. Chapter 11 in *Perspectives on Ecological Integrity*, Laura Westra and J. Lemons, editors, Kluwer Academic Publishers, pp. 162-176.

Thomas, Jack W. 1996. Forest service perspective on ecosystem management. *Ecological Applications*. 6(3): 703-705.

Wagner, Frederic H. 1995. What have we learned? *Ecosystem Management of Natural Resources in the Intermountain West*, Natural Resources and Environmental Issues, Volume 5, pp. 121-125.

Wallace, Mary G., Hanna J. Cortner, Margaret A. Moote, and Sabrina Burke. 1996. Moving toward ecosystem management: examining a change in philosophy for resource management. *Journal of Political Ecology*. 3: 1-36.

Westra, Laura. 1996a. Environmental integrity, racism, and health. *The Science of the Total Environment*. 184: 57-66.

Westra, Laura. 1996b. Ecosystem integrity and the "fish wars." *Journal Aquatic Ecosystem Health*. 5: 275-282.

Windsor, Donald A. 1998. The Endangered Species Act is analogous to Schindler's List. *Conservation Biology*. 12(2): 485-486.

About the Author:

Dr. Robert T. Lackey, senior fisheries biologist at the U.S. Environmental Protection Agency's research laboratory in Corvallis, Oregon, is also courtesy professor of fisheries science and adjunct professor of political science at Oregon State University. Since his first fisheries job more than four decades ago mucking out raceways in a trout hatchery, he has dealt with a range of natural resource issues from positions in government and academia. His professional work has involved many areas of natural resource management and he has written 100 scientific and technical journal articles. His current professional focus is providing policy-relevant science to help inform ongoing salmon policy discussions. Dr. Lackey also has long been active in natural resources education, having taught at five North American universities. He continues to regularly teach a graduate course in ecological policy at Oregon State University and was a 1999-2000 Fulbright Scholar at the University of Northern British Columbia. A Canadian by birth, Dr. Lackey holds a Doctor of Philosophy degree in Fisheries and Wildlife Science from Colorado State University, where he was selected as the 2001 Honored Alumnus from the College of Natural Resources. He is a Certified Fisheries Scientist and a Fellow in the American Institute of Fishery Research Biologists.
